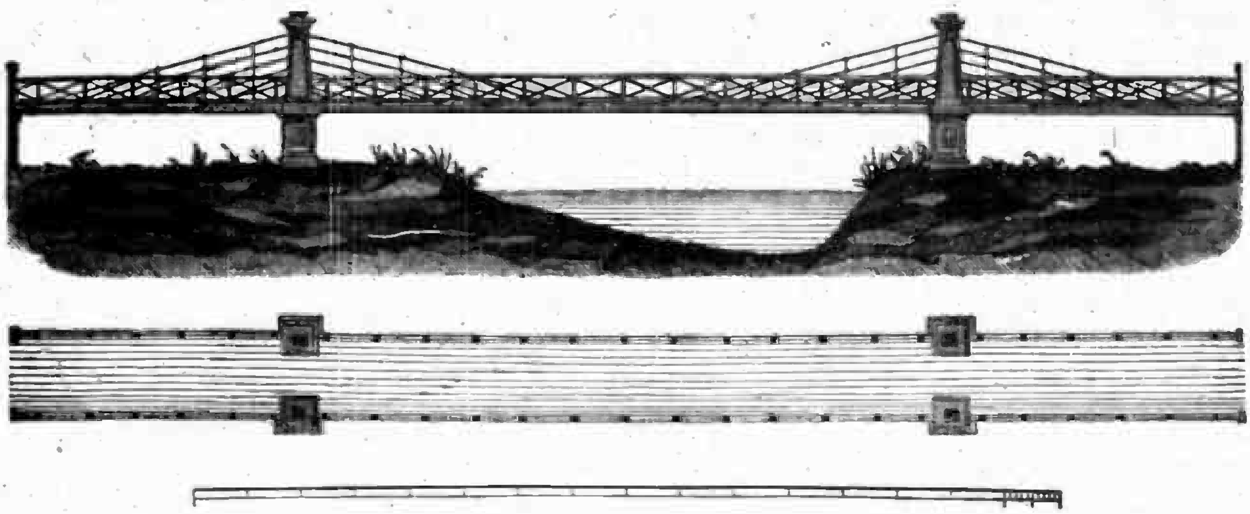

DESCRIPTION OF AN ENTIRELY NEW SUSPENSION BRIDGE,

DESIGNED BY, AND ERECTED UNDER THE SUPERINTENDENCE OF, THOMAS MOTLEY, CIVIL ENGINEER, BRISTOL.

The bridge, of which the above is a representation, was erected in 1837, over the river Avon, at Tiverton, near Bath, and is the first of the kind ever constructed. The span of the middle compartment is 120 feet, from centre to centre of the pyramids, the land ends are about 55 feet each, making the whole length of the bridge 230 feet. The road-way is 14 feet wide between the suspending bars. The four pyramids are placed, each pair, on a concrete foundation, 12 feet by 22 feet, 16 feet deep on one side and 9 feet on the other side; the concrete rests on a firm stratum of clay. The pyramids are each composed of six courses of Bath stone, 2 feet 6 inches deep, containing two blocks in each course. Their dimensions are—base, 5 feet 6 inches by 4 feet 6 inches; top, 3 feet by 2 feet 6 inches. They are covered with a capping, as shewn in the drawing. At the base of each pyramid, level with the lower part of the beam of the bridge, is a large cast-iron bed, secured by holding-down bolts inserted into other cast-iron plates in the foundation. In the centre of the large plate is inserted an iron bar, 3 inches by 1 inch, which passes up the centre of the pyramid to a cast-iron plate at the top, to which it is firmly secured. The suspending bars are 2 feet 6 inches apart, and the space between their points of attachment to the bridge about 9 feet 3 inches. The substance of these bars averages full 2 inches by 1 inch; they are welded in entire lengths, and connected on each side of the pyramid by two bars, 3 inches by half an inch, passing through the pyramid, bent in the direction of the strain, and fastened to the suspending bars by gibs and keys. On each side of the pyramid is inserted a cast-iron plate, from the base to the top suspending bar, cast with holes, through which these connecting bars pass.

The beam is composed of two bars of wrought-iron, 7 inches wide by ½ thick, in lengths of about 18 feet, each properly arranged so as to break the joints, and are connected by brace plates. At the edge of each suspending bar which connects with the beam of the bridge is welded an upright piece of iron, about a foot long, of the same substance as the upright supports, 1¼ by 1 inch, and to this the upright supports are attached by coupling joints. In the uprights are made proper eyes, through which the suspending bars pass, and are made tight by a wedge in the eyes above and below the bar, and covered over with a cast-iron rosette. Each suspending bar is attached to a round iron bolt, 2 inches diameter, which passes transversely to connect the two ribs, or beams. At the land abutment, the rib, or beam, is secured to cast-iron chairs, held down by strong iron bolts, and firmly secured to cast-iron plates, inserted in the foundation. The diagonal railing on each side of the bridge is filled in with upright round bars of iron, 1 inch diameter, about 6 inches apart—which are omitted in the drawing, to prevent a confusion of lines. The weight of wrought-iron in the suspending and upright bars is about 7 tons; the whole weight of wrought-iron, including transverse bolts, beams (or ribs), foundation plate bolts, railing, &c., about 18 tons; and of cast-iron about 5 tons. The floor is composed of Memel joists and oak platform. The joists are 12 inches deep by 3½ inches thick, bevelled off on the top from the centre to 10 inches at the ends; the flooring boards are about 9 inches wide and 2½ inches thick, and are covered with a thick coating of coal-tar and sand, on which is laid screened gravel, of an average thickness, in a convex form, to allow the water to run to the sides of the bridge.

The following was the mode of construction adopted:—The land ends of the bridge were first erected; the middle portion, over the towing path and river, was constructed by means of a platform, or hanging scaffold, suspended horizontally, by means of ropes and pulleys, from the top of the pyramid. This platform was chained to the iron work, as it extended out, so that the bridge was carried over the river without any support from beneath.

The foregoing description will, it is presumed, be sufficient to enable those who are acquainted practically to form a tolerable idea of the principles on which the bridge is built, and its effect. It may, however, be observed, that the principle is that of the inverted bracket, converting the force of compression into that of tension, and at the same time preserving as much compression as circumstances will permit, or as may be deemed requisite. It must be evident to the most superficial observer that this mode of construction and arrangement must be less flexible than a chain, and practice has proved that for stability it is unquestionably superior to suspensions with curved chains, and, therefore, will rank next to cast-iron. Loads of timber, of from six to eight tons, have passed over this bridge without producing any visible change in the floor; indeed, none can be made without either breaking or elongating the bars, except so far as the natural elasticity of wrought-iron will allow. The power of the above bridge may be nearly ascertained by treating it as a lever, which is, unquestionably, the law by which all bridges are governed. Thus the first suspending bar descends to the bridge at 2 feet 6 inches from the base of the pyramid, and extends on the floor nearly 10 feet, which is four times the height, and consequently one ton at the end would produce a strain of four tons at the pyramid, and so on in like proportion with each of the upper bars. Now there are 24 suspending bars, averaging a section of full 2 inches to each bar, which make 48 inches; then, supposing one inch of best cable iron to bear a strain of 20 tons previous to separating (though it would begin to stretch with half that strain), 48 inches would support a direct or perpendicular strain of 960 tons; but the average being 4 to 1, they would only support a uniform load of 240 tons, the weight of the materials included. Thus, if the proportion of the material were increased, say 50 per cent., it is presumed that this kind of bridge would be well adapted for railway purposes, even with such ponderous engines as are used on the Great Western Railway.

The cost of the above bridge, including the expense of masonry and very deep foundations, exclusive of embankments and approaches, was under 2,500*l.*, and was erected within 5 per cent. of the original estimate. Provided only that it be duly painted, it is presumed that the iron-work will endure even for centuries without requiring repairs of any consequence, as may be fairly expected, from its inflexible nature, and the almost entire absence of friction. It may be further observed that the joists, which are about 21 inches apart, the end projecting 9 inches, are notched about 2 inches down on the double iron beam, to which projection they are securely fixed by iron bolts with cross heads, so as to clip the lower edge of the beam, thus performing the office of cramps; and the boards being well laid, longitudinally, produce all the effects of horizontal diagonal bracing, and therefore no diagonal bracing is used, and hence the absence of an oscillating motion.

(COPY.)

Newark Iron-Works, Bath, March, 22.

Dear Sir,—In reply to your request as to my opinion of the present state of the Tiverton-bridge, which I assisted in the erection of, about six years ago, I beg to state (with the exception of an immaterial defect, produced by a slight sinking of the masonry on one side), it is as perfect and sound as when first erected, and, I have no doubt, will continue to be so for very many years, without requiring any repair, except occasionally painting. As regards my opinion, generally, of the principle of construction, I have no hesitation in stating that, under general circumstances, it is equally strong as the best proportioned suspension-bridge with curved chains, *and vastly superior to them in stiffness, and the absence of all undulation, every part being supported by direct tension.* It has also this great advantage, that the giving way, or removing, any one of the tension bars would not endanger the rest—any one of them being removable at pleasure.

I remain, yours truly,

Mr. Motley. Geo. Rayno.

REPAIRS OF WESTMINSTER BRIDGE.

We were tempted, in a moment of thoughtlessness, to extract an account of the works now carrying on at Westminster bridge from the columns of the *Times*. We saw that some pains had been taken by our illustrious contemporary to gratify its readers by a description of that interesting and important work, and we took it for granted, on having the paragraph put into our hands, that as most things are done as they ought to be by the *Times*, this was one to spare us the labour of criticism. In this, however, we were mistaken; and our attention was called to it by a correspondent who pointed out wherein the description revealed the want of a practical handling, and paid us the compliment of